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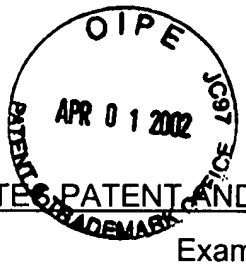

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S/N 10/045323

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Saarinen et al.	Examiner:	UNKNOWN
Serial No.:	10/045323	Group Art Unit:	2681
Filed:	10/25/01	Docket No.:	975.373USW1
Title:	DEVICE AND METHOD FOR MEASURING THE USAGE OF SYSTEM RESOURCES IN A COMMUNICATION NETWORK		

CERTIFICATE UNDER 37 C.F.R. 1.8: The undersigned hereby certifies that this Transmittal Letter and the paper, as described herein, are being deposited in the United States Postal Service, as first class mail, with sufficient postage, in an envelope addressed to: Assistant Commissioner for Patents, Washington, D.C. 20231 on 21 Mar 02

Michael B. Lasky
Name

Signature

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Washington, D.C. 20231

Dear Sir:

Enclosed is a certified copy of International application, Serial Number PCT/EP99/03045, filed 4 May 1999, the priority of which is claimed under 35 U.S.C. §120.

Respectfully submitted,

Altera Law Group, LLC
6500 City West Parkway, Suite 100
Minneapolis, MN 55344-7701
(952) 253-4106

Date: March 21, 2002 By:

Michael B. Lasky
Reg. No. 29,555
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Die angehefteten Unterlagen stimmen mit der ursprünglich eingereichten Fassung der auf dem nächsten Blatt bezeichneten internationalen Patentanmeldung überein.

Certificate

The attached documents are exact copies of the international patent application described on the following page, as originally filed.

Attestation

Les documents fixés à cette attestation sont conformes à la version initialement déposée de la demande de brevet international spécifiée à la page suivante.

Den Haag, den
The Hague,
La Haye, le

20. 11. 2001

Der Präsident des Europäischen Patentamts
Im Auftrag
For the President of the European Patent Office
Le Président de l'Office européen des brevets
p. o.

Ulrike Staab

Patentanmeldung Nr.
Patent application no. PCT/EP 99/03045
Demande de brevet n°

Blatt 2 der Bescheinigung
Sheet 2 of the certificate
Page 2 de l'attestation

Anmeldung Nr.:
Application no.:
Demande n°: PCT/EP 99/03045

Anmelder:
Applicant(s):
Demandeur(s):
1. NOKIA TELECOMMUNICATIONS OY - Espoo, Finland
2. SAARINEN, Matti - Tampere, Finland
3. ISOJARVI, Seppo - Ylöjärvi, Finland

Bezeichnung der Erfindung:
Title of the invention:
Titre de l'invention: DEVICE AND METHOD FOR MEASURING THE USAGE OF SYSTEM RESOURCES IN A COMMUNICATION NETWORK

Anmeldetag:
Date of filing:
Date de dépôt: 04 May 1999 (04.05.99)

In Anspruch genommene Priorität(en)
Priority(ies) claimed
Priorité(s) revendiquée(s)

Staat:	**Tag:**	**Aktenzeichen:**
State:	**Date:**	**File no.**
Pays:	**Date:**	**Numéro de dépôt:**

Benennung von Vertragsstaaten : Siehe Formblatt PCT/RO/101 (beigefügt)
Designation of contracting states : See Form PCT/RO/101 (enclosed)
Désignation d'états contractants : Voir Formulaire PCT/RO/101 (ci-joint)

Bemerkungen:
Remarks:
Remarques:
Further applicants:
4. TIITINEN, Jari - Espoo, Finland
5. OHVO, Mikko - Numminen, Finland
6. AALTO, Petri - Pirkkala, Finland
7. MENSIO, Armi - Vantaa, Finland
8. RANTANEN, Markku - Äänekoski, Finland

PCT REQUEST

Original (for **SUBMISSION**) - printed on 04.05.1999 12:07:51 PM

III-7	**Applicant and/or inventor**	
III-7-1	This person is:	applicant and inventor
III-7-2	Applicant for	US only
III-7-4	Name (LAST, First)	RANTANEN, Markku
III-7-5	Address:	Tärttämäentie 106 FIN-44100 Äänekoski Finland
III-7-6	State of nationality	FI
III-7-7	State of residence	FI
IV-1	**Agent or common representative; or address for correspondence** The person identified below is hereby/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as:	agent
IV-1-1	Name (LAST, First)	PELLMANN, Hans-Bernd
IV-1-2	Address:	Tiedtke-Bühling-Kinne et al. Bavariaring 4 D-80336 München Germany
IV-1-3	Telephone No.	+49 89 544690
IV-1-4	Facsimile No.	+49 89 532611
IV-1-5	e-mail	postoffice tbk-patent.com
IV-2	**Additional agent(s)**	additional agent(s) with same address as first named agent
IV-2-1	Name(s)	TIEDTKE, Harro; BÜHLING, Gerhard; KINNE, Reinhard; GRAMS, Klaus; LINK, Annette; VOLLNHALS, Aurel; LESON, Thomas, Johannes, Alois; TRÖSCH, Hans-Ludwig; CHIVAROV, Georgi; GRILL, Matthias; KÜHN, Alexander; OSER, Andreas; BÖCKELEN, Rainer
V	**Designation of States**	
V-1	Regional Patent (other kinds of protection or treatment, if any, are specified between parentheses after the designation(s) concerned)	AP: GH GM KE LS MW SD SZ UG ZW and any other State which is a Contracting State of the Harare Protocol and of the PCT EA: AM AZ BY KG KZ MD RU TJ TM and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT EP: AT BE CH&LI CY DE DK ES FI FR GB GR IE IT LU MC NL PT SE and any other State which is a Contracting State of the European Patent Convention and of the PCT OA: BF BJ CF CG CI CM GA GN GW ML MR NE SN TD TG and any other State which is a member State of OAPI and a Contracting State of the PCT

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WO 23951

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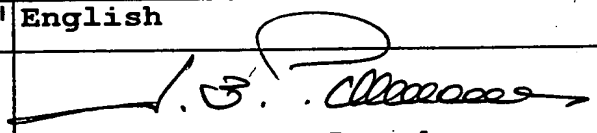
V-2	National Patent (other kinds of protection or treatment, if any, are specified between parentheses after the designation(s) concerned)	AE AL AM AT AU AZ BA BB BG BR BY CA CH&LI CN CU CZ DE DK EE ES FI GB GD GE GH GM HR HU ID IL IN IS JP KE KG KP KR KZ LC LK LR LS LT LU LV MD MG MK MN MW MX NO NZ PL PT RO RU SD SE SG SI SK SL TJ TM TR TT UA UG US UZ VN YU ZA ZW
V-5	**Precautionary Designation Statement** In addition to the designations made under items V-1, V-2 and V-3, the applicant also makes under Rule 4.9(b) all designations which would be permitted under the PCT except any designation(s) of the State(s) indicated under item V-6 below. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit.	
V-6	**Exclusion(s) from precautionary designations**	NONE
VI	**Priority claim**	NONE
VII-1	**International Searching Authority Chosen**	European Patent Office (EPO) (ISA/EP)

		number of sheets	electronic file(s) attached
VIII	**Check list**		
VIII-1	Request	5	-
VIII-2	Description	13	-
VIII-3	Claims	3	-
VIII-4	Abstract	1	wo23951a.txt
VIII-5	Drawings	1	-
VIII-7	TOTAL	23	
	Accompanying items	paper document(s) attached	electronic file(s) attached
VIII-8	Fee calculation sheet	✓	-
VIII-16	PCT-EASY diskette	-	diskette

VIII-18	**Figure of the drawings which should accompany the abstract**	1
VIII-19	**Language of filing of the international application**	English
IX-1	**Signature of applicant or agent**	
IX-1-1	Name (LAST, First)	PELLMANN, Hans-Bernd

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10-1	**Date of actual receipt of the purported international application**	(04. 05. 99) 04 MAY 1999
10-2	**Drawings:**	
10-2-1	Received	- 4 MAY 1999
10-2-2	~~Not received~~	
10-3	**Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application**	
10-4	**Date of timely receipt of the required corrections under PCT Article 11(2)**	

DEVICE AND METHOD FOR MEASURING THE USAGE OF SYSTEM RESOURCES IN A COMMUNICATION NETWORK

Field of the Invention

The present invention relates to a device and method for measuring the usage of system resources in a communication network. Furthermore, the present invention relates to a method for dimensioning system resources for a usage by transmissions in a system.

Related Background Art

In the field of mobile telecommunications, there is right now the opportunity to provide new mobile services which are beyond voice transmission. These messaging services are, however, presently limited to a transmission rate of 9,6 kbit/s.

Therefore, proposals for new technologies have been made how to increase the transmission bit rates. The solution for a packet switched data submission will most presumably be the General Packet Radio Service (GPRS) which is mainly intended for the interconnection to packet switched networks such as the Internet. However, for the connectivity to the existing circuit switched networks, the Integrated Services Digital Network (ISDN) and the Public Switched Telephone Network (PSTN), one of the mostly favored solution is the High Speed Circuit Switched Data (HSCSD) technology.

The reason therefor is that HSCSD enables the co-allocation of multiple full rate traffic channels into a HSCSD configuration. The aim of HSCSD is to provide a mixture of services with different air interface user

rates by a single physical layer structure. The available capacity of a HSCSD configuration is several times the capacity of a full rate traffic channel, leading to a significant enhancement in the air interface data transfer rate.

Moreover, HSCSD uses a new channel coding scheme to enhance the bit rate of one time-slot from 9,6 kbit/s to 14,4 kbit/s. This increase is achieved by puncturing error correction bits of the 9,6 kbit/s channel coding. Hence, the transmission speed of only one time slot is 50% faster.

Thus, by combining these two features of HSCSD, a maximum HSCSD bit rate of 57,6 kbit/s uncompressed is available, which is comparable to one ISDN B-channel. Accordingly, when HSCSD is introduced, GSM data will be on par with existing PSTN modem services. For the technical specification of HSCSD, reference is made to document GSM 03.34 of the European Standards Telecommunications Institute.

However, the HSCSD technology is unfortunately associated with some problems. Since HSCSD uses several time slots for a single communications session, this multi-slot occupation is a heavy load for a single cell. Accordingly, when planning the provision of resources for the cells of a network, the traffic density of the network has to be taken into account. Since to date there is assumed a statistical distribution of the traffic density over time and space, this suffers from another significant drawback: If many subscribers use HSCSD simultaneously and thus occupying a rather huge amount of time slots, the actual traffic distribution can change

considerably, probably leaving no time slot left for a later caller.

In addition, an introduction of new channel codings generally requires respective capabilities (e.g. hardware) to be implemented in a suitable location in a communication network.

Summary of the Invention

Therefore, it is an object of the present invention to provide a device for measuring the usage of system resources in a communication network which is free from the above drawbacks.

According to the present invention, this object is achieved by a device for measuring a usage of system resources in a communication network, said device comprising means for measuring which radio resources are used by a transmission in a system; means for measuring which data service units are used for said transmission in a system; and means for measuring which transmission characteristics are used by said transmission in a system, wherein all of said means are adapted for a respective collective measurement.

Furthermore, the object is achieved by a method for measuring a usage of system resources in a communication network, said method comprising the step of measuring parameters of circumstances of a transmission in a system, said parameters being at least radio resources used by said transmission in a system, data service units used for said transmission in a system, and transmission characteristics used by said transmission in a system, wherein said measuring is carried out collectively.

Advantageous further developments of the present invention are as set out in the respective dependent claims.

Hence, it is an advantage of the present invention that the device and method for measuring a usage of system resources in a communication network by a transmission provide a collective and thus dependent measurement of the load distribution in the communication network. Thus, according to the invention, there is provided most accurate information about any system resource dependencies in the communication network during a transmission. Consequently, the distribution of the load on the system resources during a transmission, particularly with respect to those dependencies, can be achieved. Stated in other words, the invention can provide an unambiguous identification of the system resource usage by a transmission in a system.

Accordingly, this invention provides a helpful tool for dimensioning system resources in communication networks by evaluating these overall characteristics. Particularly, the problems encountered by the usage of high speed circuit switched data or other new channel codings to be introduced can be effectively met when adopting the invention. Therefore, by incorporating an analysis according to this invention to the existing GSM network can help to pave the way for the introduction of HSCSD and other new channel codings to be introduced.

Preferred embodiments of the present invention are described herein below in detail by way of example with reference to the accompanying drawings.

Brief Description of the Drawings

Fig. 1 shows a communication network architecture for supporting high speed circuit switched data having incorporated the device according to a preferred embodiment of the invention.

Description of the preferred Embodiments

According to the present invention, a usage of system resources in a communication network is measured collectively, thereby detecting all occurring dependencies under the used system resources, such as hardware, frequency bands, traffic channels, or the like. The expression "system" is used in this description as a term superior to a network, i.e. a system can for example be two or more networks constituting a communication system.

Circumstances of a transmission in a system are defined at least by radio resources used by the transmission in a system, data service units used by the transmission in a system and transmission characteristics used by the transmission in a system. Other parameters for defining the circumstances of a transmission in a system are conceivable, but the description of the present invention should here be left being limited to these three examples for parameters of the circumstances of a transmission in a system for the sake of distinctness. It is noted that the term circumstance of a transmission in a system is also meant to include also bearer service characteristics.

From later given examples for the parameters and their description it can easily be seen that the usage of

system resources in the system will be strongly dependent on the above mentioned parameters of the circumstances of a transmission in a system. Stated in other words, every different type of transmission will use the available system resources in a communication network to a different extent. To date, there are already a lot of transmission types present, like voice calls, emails, file transfer, and the like, whose system resource load might be foreseeable, but rather be dependent on characteristics of the respective sender-receiver pair. Anyway, the ratio of all thinkable transmission types and the respective circumstances of their transmission in a system to each other with regard to their distribution over time and space is surely not foreseeable and thus needs an accurate analysis, particularly when additionally taking the above mentioned problems with an introduction of HSCSD or other new channel codings into account.

The basic idea to provide such an analysis is to add a device for measuring the usage of the system resources in the system to the respective communication network. Therein, the measurement is done collectively, so that any respective dependency of that system resource usage is detected and identified. By evaluating the thus provided analysis data, one could perform a very precise dimensioning method for system resources in a communication network, particularly in view of the introduction of novelties of any kind to the communication network.

Apart from the example of HSCSD, which will be referred to herein below, there is a further example of a new channel coding method called Enhanced Data rates for GSM Evolution (EDGE). The present invention is also

applicable to that, since the EDGE channel coding also uses a dynamical system resource load and architecture proposals in ETSI change requests reuse HSCSD principles. Thus, very similar problems and respective solutions according to this invention as discussed herein can apply to the EDGE channel coding.

As can be seen from the foregoing, the present invention has a broad scope for an adoption in any communication network/system encountering the above outlined problems. However, the further description of the present invention will be made by the example of High Speed Circuit Switched Data HSCSD in GSM networks for the sake of explanation. Nevertheless, it is expressly mentioned that the present invention is not limited thereto.

With reference to the above mentioned explanations about the HSCSD and its functionality in GSM networks there are now some examples for circumstances of the operation of the device according to the invention and its corresponding measurement method given, so that the idea of the invention will become more apparent.

Referring now to Fig. 1, there is shown a GSM network architecture for supporting high speed circuit switched data HSCSD having incorporated the device according to the preferred embodiment of the invention. As can be gathered therefrom, a mobile station MS (shown on the far left) has incorporated a terminal adaptation function TAF which provides facilities to allow manual or automatic call control functions associated with alternate speech/data, speech followed by data and circuit switched data services. There are several functions included in the terminal adaptation function TAF from which, at this point, it is only important that HSCSD is supported.

The mobile station MS is connected to its respective base transceiver station BTS via the air interface AIR I/F. According to HSCSD, the connection of the mobile station MS is provided by n full-rate channels or n time slots per time division multiple access (TDMA) frame, with n being an integer. Although these n channels are physically different channels, according to HSCSD, the n full rate traffic channels at the radio interface logically belong to the same HSCSD configuration. Accordingly, the channels are controlled as one radio link for the purpose of cellular operations. Corresponding to the number of channels, the data streams are split into n separate data streams before their submission and afterwards combined together again.

The connection between the base transceiver station BTS and a respective base station controller BSC is established by an Abis interface Abis I/F and also has n traffic channels. A splitting and combining of data streams is made in the mobile station MS and in the base station controller BSC, while an allocation of channels is provided in a respective Base-station Subsystem (BSS) by the base station controller BSC.

However, when leaving the Base-station Subsystem (BSS), a transmission is submitted to a corresponding mobile services switching center MSC via an A interface A I/F, wherein a respective use of resources is restricted to one 64 kbit/s A interface A I/F circuit. Thus, the data streams of the transmission are multiplexed into that circuit.

Since one main reason for the planned introduction of HSCSD is establishing an excellent and fast data exchange

with potential data service supporting networks like the PSTN and ISDN, the example depicted in Fig. 1 has an Inter Working Function IWF incorporated in the mobile services switching center MSC. This Inter Working Function IWF, however, can in principle provide links to any other network which can be another PLMN, but more likely an ISDN, a PSTN, a Packet Switched Public Data Network PSPDN or a Circuit Switched Public Data Network, or the like.

With regard to HSCSD, the Inter Working Function IWF plays an important role for a secure and fast transmission from or to the network. When a transmission is routed to the Inter Working Function IWF, it selects a free and suitable resource out of the data service unit resource pool contained in the Inter Working Function IWF for the connection to the other network. Then, the transmission is adapted and converted in the Inter Working Function IWF and finally routed to the terminated external network as ISDN or PSTN.

According to the present invention, a device MD for measuring the usage of system resources in a network is preferably located in the Mobile Services Switching Center MSC, but can optionally also be in another location suitable for measuring the above mentioned parameters, for example in the Base-station Subsystem (BSS).

Anyway, this measuring device MD measures the three above mentioned parameters of the circumstances of transmission. Radio resources used by the transmission can for example be the number of traffic channels allocated by the Base-station Subsystem (BSS) or the channel coding used during the data call. Further, the

data service units selected means for example a functionality (e.g. hardware) included in the Inter Working Function IWF, in the Mobile Services Switching Center MSC itself and/or in the Base Transceiver Station BTS. Finally, the transmission characteristics can be the parameter Information Transfer Capabilities ITC, which is part of octet 3 of a bearer capability information element BCIE described in the technical specification GSM 04.08, chapter 10.5.4.5: "bearer capability" and can currently have the values: Speech; unrestricted digital information; 3,1 kHz audio, ex PLMN; facsimile group 3; other ITC. Apart from that, further enhancements are possible in the future.

With the knowledge about the nature of these parameters, several designs of means for measuring them are thinkable. It is noted, that the design of the means for measuring the parameters of the circumstance of the transmission does not need to result in three separated units. When mentioning means for each parameter separately, this should only express that the functionality for measuring each parameter separately is present. This applies in a quite similar way for means for detecting and identifying each respective dependencies of the system resource usage by a transmission in a system. This should also express a functionality with which the respective measurement results can be evaluated in the desired manner.

In this connection, it should be further noted that the presence of the evaluation means in the measuring device is not absolutely required, in contrast to the measuring means and their collective measuring nature with respect to each other. Although the functionality of the evaluation means is very advantageous for the

determination of the overall characteristics of a system resource usage in a communication network, it is conceivable that this functionality is present in a location elsewhere in the network. However, the close connection between a collective measurement and the evaluation of dependencies between the measurement results makes a close physical arrangement appear desirable. From such an arrangement, for example, a reduction of the information data to be submitted from the measuring device seems to be possible.

With the measuring device being in one or the other way such present, the collective measurement of the above mentioned three parameters of the circumstance of the transmission is performed. After that, dependent on the presence of the evaluation means, there are first each respective dependencies of a system resource usage by transmissions in a system detected and identified and then respective data is submitted, or the data is immediately submitted.

The receiver of this submitted data is, according to the present invention, not limited to a particular destination. However, it is a location (physically or logically) where the data is to be handled for an analysis of the usage of system resources in the communication network and this is the location where a suitable system resource configuration for the then present overall load on the network can be dimensioned.

To be precisely, the circumstances of the transmissions are according to the aforesaid determined, i.e. that determination is based on results provided by the measuring device with or without the evaluation means. Further, also changes of said circumstances during said

transmissions are determined therein. Next, an intensity of data traffic in the communication network is calculated from reservation times of the data service units used by said transmissions and from release times of said transmissions, wherein also a change of a radio channel configuration therein is considered by updating said calculation. According to the invention, this calculation can be performed separately for each of said circumstances of said transmissions, or separately for each parameter of said circumstances of said transmissions. Anyway, each dependence present between said results of said measurements, said determination steps and said calculation steps is determined thereafter. Then, the statistics including the results of the measurements, the determination steps and the calculations are generated and these generated statistics are processed for the dimensioning of suitable system resources for a usage by transmissions in a system, particularly under consideration of novelties to be introduced into the communication network.

From the foregoing it becomes fully apparent that the present invention is capable to provide an effective instrument to deal with the introduction of novelties into a communication network with respect to the dimensioning of probably additionally required system resources in that communication network. In particular, also the required system resources with respect to dynamical load changes in the network, as can appear with high speed circuit switched data HSCSD or other new channel codings to be introduced, can be determined in highly accurate manner.

Accordingly, as is described before, the present invention proposes a device for measuring a usage of

system resources in a communication network, said device comprising means for measuring which radio resources are used by a transmission in a system; means for measuring which data service units are used for said transmission in a system; and means for measuring which transmission characteristics are used by said transmission in a system, wherein all of said means are adapted for a respective collective measurement, and a method for measuring a usage of system resources in a communication network, said method comprising the step of measuring parameters of circumstances of a transmission in a system, said parameters being at least radio resources used by said transmission in a system, data service units used for said transmission in a system, and transmission characteristics used by said transmission in a system, wherein said measuring is carried out collectively. According to the present invention, it is possible to provide a method for dimensioning system resources for a usage by transmissions in a communication network with this device and method for measuring the usage of system resources in a communication network.

It should be understood that the above description and accompanying figures are only intended to illustrate the present invention by way of example only. The preferred embodiments of the present invention may thus vary within the scope of the attached claims.

Claims

1. A device for measuring a usage of system resources in a communication network, said device comprising

means for measuring which radio resources are used by a transmission in a system;

means for measuring which data service units are used for said transmission in a system; and

means for measuring which transmission characteristics are used by said transmission in a system, wherein all of said means are adapted for a respective collective measurement.

2. A device according to claim 1, wherein said transmission characteristics comprise an information transfer capability information.

3. A device according to claim 1, further comprising evaluation means for detecting and identifying each respective dependencies of said system resource usage by evaluating measurement results of said three measuring means.

4. A device according to claim 1, wherein said device is part of a switching center of said communication network.

5. A device according to claim 1, wherein said device is part of a base-station subsystem of said communication network.

6. A device according to claim 1, wherein said transmission contains high speed circuit switched data.

7. A device according to claim 1, wherein said transmission contains data which is channel coded according to Enhanced Data rates for GSM Evolution.

8. A method for measuring a usage of system resources in a communication network, said method comprising the step of

measuring parameters of circumstances of a transmission in a system, said parameters being at least radio resources used by said transmission in a system, data service units used for said transmission in a system, and transmission characteristics used by said transmission in a system, wherein said measuring is carried out collectively.

9. A method according to claim 8, wherein said transmission characteristics comprise an information transfer capability information.

10. A method according to claim 8, further comprising the step of

detecting and identifying each respective dependencies of said system resource usage.

11. A method according to claim 8, wherein said measurements are carried out in a switching center of said communication network.

12. A method according to claim 8, wherein said measurements are carried out in a base-station subsystem of said communication network.

13. A method according to claim 8, wherein said transmission contains high speed circuit switched data.

14. A method according to claim 8, wherein said transmission contains data which is channel coded according to Enhanced Data rates for GSM Evolution.

15. A method for dimensioning system resources for a usage by transmissions in a system, said method comprising the steps of

determining circumstances of said transmissions in a system, wherein said determination is based on results of one of the methods according to claims 8 and 10, respectively, and wherein in said determination step also changes of said circumstances during said transmissions are determined;

calculating an intensity of data traffic in a communication network from reservation times of said data service units used by said transmissions and from release times of said transmissions, considering also a change of a radio channel configuration therein by updating said calculation, wherein said calculation step is performed separately for each of said circumstances of said transmissions;

determining each dependence present between said results of said measurements, said determination steps and said calculation steps;

generating statistics including said results of said measurement steps, said determination steps and said calculation steps; and

processing said generated statistics for dimensioning said system resources for said usage by said transmissions in a system.

16. A method according to claim 15, wherein said calculation step is performed separately for each parameter of said circumstances of said transmissions.

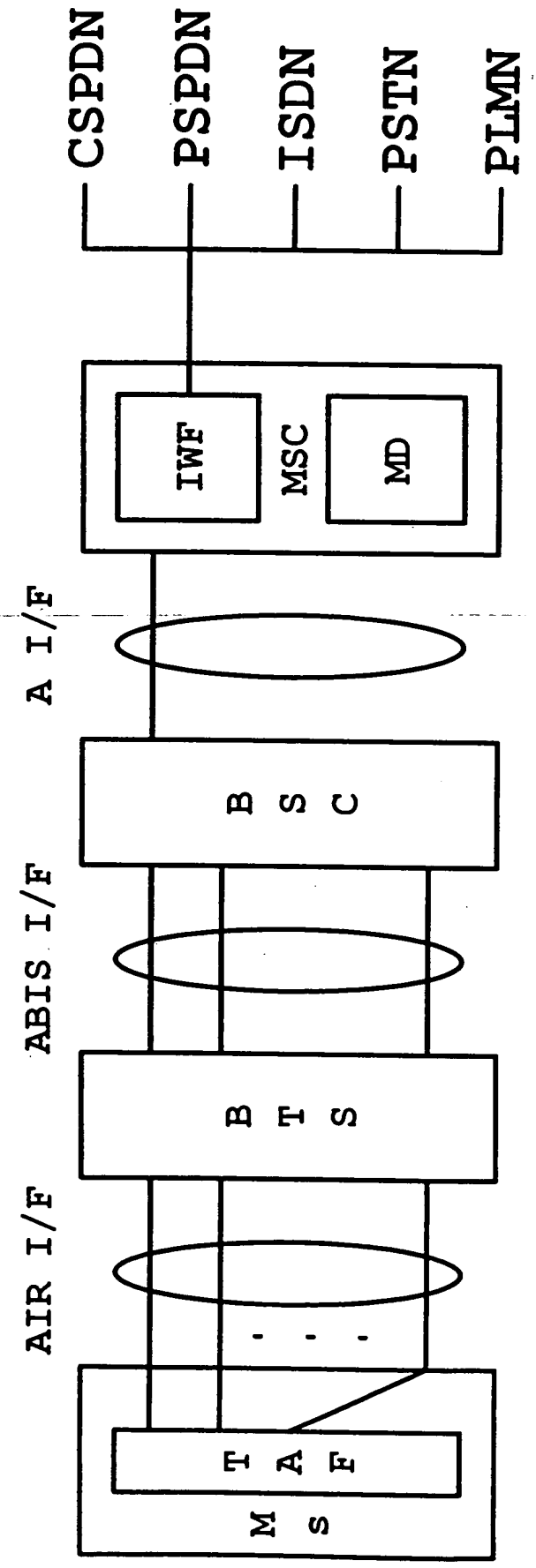
The present invention proposes a device for measuring a usage of system resources in a communication network, said device comprising means for measuring which radio resources are used by a transmission in a system; means for measuring which data service units are used for said transmission in a system; and means for measuring which transmission characteristics are used

by said transmission in a system, wherein all of said means are

adapted for a respective collective measurement, and a method for measuring a usage of system resources in a communication network, said method comprising the step of measuring parameters of circumstances of a transmission in a system, said

parameters being at least radio resources used by said transmission in a system, data service units used for said transmission in a system, and transmission characteristics used

by said transmission in a system, wherein said measuring is carried out collectively. According to the present invention, it is possible to provide a method for dimensioning system resources for a usage by transmissions in a communication network with this device and method for measuring the usage of system resources in a communication network.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T A F
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FIG. 1